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Lead Levels in Fresh Medicinal Herbs and Commercial Tea Products from Manila, Philippines

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Abstract

Alternative medicine utilizing the therapeutic effects of plants is commonly used in the community. Contaminants in the raw materials, like lead, may lead to adverse health effects. This study aimed to determine the presence or absence of lead and specifically aimed to obtain its levels in plants and commercial tea utilized as herbal medicine in Manila, Philippines. The blood levels of the heavy metals were mathematically projected as well. The concentrations were compared with the World Health Organization (WHO) and Center for Disease Control (CDC) allowable standards for plants and blood, respectively. Flame Atomic Absorption Spectrophotometry (FAAS) was used to analyze the heavy metals from the samples. All samples tested contained lead but conformed with the WHO limits at 10 ppm. However, only the tea preparation samples conformed with the CDC limit at 10 ug/dL but not the collected plants which went above the prescribed concentration. Herbs and its preparations must be decontaminated prior to use for better health provision to the Filipino people.

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1. Introduction

1.1. Background

The use of plants as medicinal substances (crude or processed), have long been utilized. It is the foundation

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of modern medicine, botany, pharmacy, aromatherapy and chemistry. Herbalism is both an art and a science [1]. The World Health Organization (WHO) stated that over 80% in Asian and African populations use traditional medicine for primary health care where herbal medicine is an integral part of [2,3]. Further WHO estimated that about 70% to 80% of the population in developed countries also used some form of alternative or complementary medicine including Ayurvedic, homeopathic, naturopathic, traditional oriental, and Native American Indian medicine [2,4]. Though plants are naturally grown from soil, studies revealed association of its use to adverse effects in the kidneys [2,5] and liver [2,6]. Over the past 30 years, the use of herbal supplements has increased. Herbal supplements are classified as dietary supplements by the U.S. Dietary Supplement Health and Education Act (DSHEA) of 1994. These must be made according to good manufacturing practices, but not necessarily tested for safety and effectiveness [7].

Lead results to adverse effects on the renal, endrocrine, digestive, cardiovascular, reproductive system. It affects development and neurologic system the most. WHO recommended 10 mg/kg or 10ppm as the maximum permissible level of lead in medicinal plants [9], [10].

1.2. Objectives

This study in general, aimed to determine the presence or absence of lead in plants and commercial tea usually utilized as herbal medicine in the Manila communities. Specifically, the determined levels were compared with the maximum acceptable limits set by the WHO for lead in plants. The projected blood levels were compared with the acceptable limit set for lead in blood by the Center for Disease Control.

1.3. Significance of the study

By the determination of the levels of lead in the usual community plants used as herbal medicines and herbal tea preparations in the market, the Filipino population will be given the chance to choose intelligently to avoid contaminations. The Food and Drug Authority may come up with more stringent policies and its strict implementation for herbal preparation/nutritional supplements in the commercial market. The Department of Agriculture together with the Department of Environment and Natural Resources may tie up for environmental clean-up to decontaminate plants grown in Manila, Philippines.

2. Methodology

2.1. Research Design

The study followed the descriptive exploratory design. The amounts of the lead in the varied samples collected were experimentally explored using FAAS for analysis. The results described the content of lead in the medicinal plants and tea preparations.

2.2. Locale of the Study

The study was conducted in Manila Philippines from April to May of 2013. Samples were collected from Ongpin, Ermita and Divisoria areas. The samples were quantitatively analyzed at Dela Salle University Manila, Philippines

2.3. Collection and preparation of Samples

One kilogram of the fresh leaves of the plants was collected on three different busy areas in the site. These were stored in brown bags and subjected to air drying prior to preparation and analysis. The herbal tea preparations were bought from three Chinese Herbal stores in Manila, Philippines. These were stored in a cool, dry place inside microwave dishes prior to preparation and analysis.

Five (5) grams of each sample were pre-digested in 10 mL concentrated nitric acid in an open glass container for 24 hours, at room temperature. After 24 hours the samples were heated at 80°C for 5 hours. Samples were then cooled to room temperature, and the volumes were adjusted to 50 mL with distilled water. Diluted samples were stored in polyethylene (PET) bottles and were analyzed using flame atomic absorption spectroscopy [11]

2.4. Analysis

The data collected were analyzed by comparing the heavy metal concentrations in the materials with the standard set by WHO. The projected blood levels of lead were computed mathematically considering its absorption rate in both children and adults. The amounts were compared with the acceptable safe limits set by the Center for Disease Control.

3. Results and Discussion

Herbal tea preparations and herbal plants have its folkloric uses. These are being developed into herbal supplements because of different suggested therapeutic claims. Green Barley tea, grape seed extracts, bitter gourd, bignay, banaba, sambong, malunggay and guyabano tea have their own purported therapeutic uses. Most contain antioxidants. In general these herbs together improve the cardiovascular, digestive, nervous, renal, reproductive, respiratory, immune system, fight cancer, and treat diabetes[12,13,14,18]. Malunggay particularly combat malnutrition and is an anti-inflammatory, anti-infective, anti-bacterial, and anti-fungal.[15]. Bignay treats kidney and liver disorders while Banaba treats kidney dysfunction [16], [17]. **G**uyabano leaves act as sudorific, diuretic, emetic, tranquilizer ,sedative, treatment to head lice, bedbugs and other parasites. It also treats inflammation, eczema and skin diseases.[19]. Most users of Bgl and Wcc tea claim that it causes weight reduction.

Garlic treats respiratory, gastrointestinal, respiratory, cardiovascular and liver disorders, diabetes, fever, and cancer [20]. Oregano have antioxidants and are used as antiseptic, anti-inflammatory substance, anti-itch, anti-dandruff, anti-lice and anti- arthritic. It also cures respiratory and stomach ailments [21].Lagundi is used primarily for the treatment of respiratory problems[22] In the Philippines, yerba buena is an antidote to stings of poisonous insects, used for gastrointestinal problems, and fever [23].Niyogniyogan is used primarily as anthelmintic and treatment to skin diseases[24]. Guava treats gastrointestinal problems, and is used as disinfectant, antiseptic, blood pressure lowering and good cholesterol increasing substance [25].

The therapeutic potentials of medicinal herbs must be used without compromising patients' health because of unknown contaminants in it. From the data, none went above the acceptable limit set by WHO for lead in medicinal plants at 10ppm [9,10]. The projected levels of lead in blood for both children and adults, upon intake of tea preparations, did not go beyond the safe limits set by the Center for Disease Control at 10ug/dL [26]. However, if the current limit of 5ug/dL for lead in blood will be used, then Banaba Tea, among children (50% absorption) exceeded the standard set. Wcc and Gyb Tea showed no detectable (ND) levels of lead. It could mean that the samples were totally free of the heavy metal or the amount present did not reach the sensitivity of the instrument used. Since no detectable amounts for the said two samples were registered, no computations (NC) were performed to the projected blood lead levels (Table 1).Though all leaf samples showed amounts of lead within the acceptable limits set by WHO, one time ingestion of one kilogram of the

leaves may result to projected blood levels beyond the limits deemed safe by the Center for Disease Control (Table 2). The lead in the plants is adsorbed and absorbed since the samples were not washed prior to drying. In general, the processing of herbal plants to produce tea includes washing prior to drying. Part of the adsorbed lead will then be removed with such additional step. Soil, air and water in Metro Manila, Philippines are contaminated with lead [27]. Plants are grown in soil where the contaminants will be absorbed, as it is carried by contaminated water sources, to all its parts. Plants are under the contaminated atmosphere such that lead will find its way through all of its parts. Even small amounts of lead may result to accumulation in the biosystem and may result to chronic intoxication.

Table 1. Mean lead concentration in herbal tea/drink and blood as projected by computation

Herbal Tea/Drink (brands withheld)	Lead Mean (ppm)	mcg/dL	mcg/dL (50%)	mcg/dL (30%)
Ampalaya	0.086 +/- 0.0008	8.6	4.3	2.58
Green Barley	0.081 +/- 0.0006	8.1	4.05	2.43
Grape seed	0.079 +/- 0.0012	7.9	3.95	2.37
Malunggay	0.023+/- 0.0273	2.3	1.15	0.69
Bignay	0.051 +/- 0.0057	5.1	2.55	1.53
Banaba	0.157 +/- 0.2332	15.7	7.85	4.71
Sambong	0.006 +/- 0.0161	0.6	0.3	0.18
Bgl Tea	0.032 +/- 0.0096	3.2	1.6	0.96
Wcc Herbal Tea	ND	NC	NC	NC
Guyabano	ND	NC	NC	NC

Table 2. Mean lead concentration in medicinal plants and blood as projected by computation

Medicinal Plant	Lead Mean (ppm)	mcg/dL	mcg/dL (50%)	mcg/dL(30%)
Bawang *Allium sativum* Linn.	0.873 ± 0.0001	87.3	43.65	26.19
Guyabano *Anona muricata* Linn.	0.652 ± 0.0023	65.2	32.6	19.56
Ampalaya *Momordica charantia* Linn.	0.671 ± 0.0006	67.1	33.55	20.13
Oregano *Origanum vulgare* Linn	0.756 ± 0.0007	75.6	37.8	22.68
Sambong *Blumea balsamifera* (L.) DC	0.823 ± 0.0017	82.3	41.15	24.69
Lagundi *Vitex negundo* Linn.	0.632 ± 0.0015	63.2	31.6	18.96
Yerba Buena *Mentha arvensis* Linn.	0.791 ± 0.0010	79.1	39.55	23.73
Malunggay *Moringa oleifera* Lam	0.704 ± 0.0016	70.4	35.2	21.12
Niyog-Niyogan *Quisqualis indica* Linn	0.698 ± 0.0008	69.8	34.9	20.94
Bayabas *Psidium guajava* Linn.	0.818 ± 0.0006	81.8	40.9	24.54

4. Conclusions and Recommendations

Hence from the analyzed data of this research, it was observed that all plant and commercial tea samples contained lead. None however went beyond the acceptable standard limit set by the World Health Organization at 10ppm. All projected blood levels of lead based on the amounts of the heavy metal in the tea product samples tested were within the safe blood limit set by the Center for Disease Control at 10 ug/dL. All projected levels of blood for the plants went beyond the safe limits set. Relevant Philippine government agencies as the Department of Environment and Natural Resources and the Food and Drug Authority, may work together to improve the environment and lessen the contaminants in herbal medicinals and its products.

References

[1] Barrera, J. D.L. *Infoherb* [Online] Available at: http://www.infoherb. com/Herbal_ medicine.html

[2] Oreagba,IA, Oshikoya,KA, Amachree,M. Herbal medicine use among urban residents in Lagos, Nigeria. *BMC Complementary and Alternative Medicine* 2011, 11:117 available at www.biomedcentral.com/1472-6882/11/117

[3] WHO Media Centre: Traditional Medicine available at http://www.who. int/mediacentre /factsheets/fs134/en/.Fact*sheet N°134* 2008.

[4] World Health Organization: Traditional Medicine Strategy 2002- 2005 available at http://whqlibdoc.who.int/hq/2002/who_edm_ trm_2002.1.pdf] WHO/EDM/TRM/2002.1, Geneva*:7.*

[5] Abt AB, Oh JY, Huntington RA, Burkhart KK: Chinese herbal medicine induced acute renal failure.*Archives of Internal Medicine 1*995**,** 155**:**211-212.

[6] Oshikoya KA, Njokanma OF, Chukwura HA, Ojo OI:*Perinatal Drug Therapy* 2007, **8:**81-88.

[7] Ehrlich, S. D. *Herbal Medicine*. University of Maryland Medical Center. October 2011 Available at: http://umm.edu/health/medical /altmed/treatment/herbal- medicine#ixzz2eJHPKfs9

[8] Agency for Toxic Substances and Disease Registry.2010.Environmental Health and Medicine Education available at http://www.atsdr.cdc.gov/csem/csem.asp?csem=7&po=10

[9] World Health Organization, Evaluation of Certain Food Additives and Contaminants. WHO Technical Report Series 776, Geneva: World Health Organization.,1989

[10] World Health Organization. Quality Control Methods for Medicinal Plant Materials, WHO Geneva Switzerland, 1998.

[11] L.Prester. "Decomposition of Fish Samples for Determination of Mercury". Arh hig rada toksikol, 49 (4), 343-348,1998.

[12] 7 Healthy Drinks and Benefits. 2012. Happy Dietician, 2012 available at http://www.happydietitian.wordpress.com/2012/01/18/7-healthy-drinks-benefits

[13] What Is Grape Seed Extract? What Are The Benefits Of Grape Seed Extract? 2013 available at http://www.medical newstoday. com/articles/263332.php

[14] What are the Benefits of Ampalaya Tea? nd Available at http:// www.livestrong.com › Diet and Nutrition › Beverages and Health

[15] Medical Health Guide. Malunggay Uses, Health Benefits, Side Effects, Preparations.nd available at http:// www.medicalhealt hguide.com/articles/malunggay.htm

[16] Health Benefits of Bignay Tea.. Health Talk 2012 available at http:// www.healthtalkbuzz.com/2012/09/health-benefits-of-bignay-tea.html

[17] Medical Health Guide. Banaba Uses, Health Benefits, Side Effects nd available at http:// www.medicalhealthguide. com/articles/banaba.htm

[18] Medical Health Guide. Sambong Uses, Health Benefits, Side Effects nd available at http:// www.medicalhealthguide. com/articles/sambong.htm.

[19] Medical Health Guide. Guyabano Uses, Health Benefits, Side Effects nd available at http://www.medicalhealthguide.com /herb/guyabano.htm

[20] Medical News Today. What are the Benefits of Garlic?" . Sept 2013 available at http:// www.**medical**newstoday.com /articles/265853.php

[21] Medical Health Guide. Oregano Herbal Medicine Uses, Health Benefits, Side Effects available at http:// www.medicalhealthguide. com /articles/**oregano**.htm

[22] Medical Health Guide. Lagundi Herbal Medicine, Health Benefits and Side Effects nd available at http:// www.medicalhealthguide. com/articles/**oregano**.htm

[23] Philippine Medicinal Plants. Yerba 2012.Buenaavailable at http:// *ww*w.stuartxchange.com/ Yerba.html

[24] Philippine Medicinal Plants. Niyog niyogan. 2004available at http:// www.filipinoherbshealingwonders.filipinovegetarian recipe.com/**niyog-ni**

[25] Singh,CV.,Guava (Amrood): Health Benefits and Useful Properties 2013 available at http:// *www*.cvsingh.hubpages.com › Health

[26] Center for Disease Control and Prevention.. CDC 24/7 Saving Lives Protecting People 2012available at http://www.cdc. gov/nceh/lead .../blood_lead_levels.

[27] Solidum, Judilyn N. Distribution of Airborne Lead in Metro Manila Philippines. *Journal of Environmental Science and Management* Vol 11, Number 2, 2008. http://journals.uplb.edu.ph/index.php/JESAM/article/view/75